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RESEARCH

Assessment of Processed Meat Consumption in Children (6 -10 Years Old): Sample of an Elementary School in Istanbul, Turkey

Evaluación del consumo de carnes procesadas en niños (6-10 años): Muestra de una escuela primaria en Estambul, Turquía

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ABSTRACT

Introduction: Processed meat has undesirable effects on overall diet quality especially in children and adolescents because the high consumption could increase the prevalence of obesity, cardiovascular disease, diabetes, and cancer. This study was carried out to evaluate the processed meat consumption of children (between 6-10 ages) and to observe their parents' attitudes on processed meat consumption and purchasing.

Material and methods: A cross-sectional study was conducted with 297 children in the 1st to 4th classes of an elementary school in İstanbul and their parents. Children processed meat consumption and parents' opinion about processed meat, attitudes during shopping were analyzed. Chi-square, Spearman correlation, Kruskal Wallis (Tamhane) analyses were applied with Statistical Package for the Social Sciences (SPSS). Results were assessed in 95% confidence interval (CI) and $p < 0.05$ significance level.

Results: The first parents' attitude during shopping was analyzed expiration date. The price tag on the package was the last attitude. Body Mass Index (BMI) of children and processed meat consumption wasn't related statistically ($p>0.05$), but increasing age was statistically related to higher processed meat consumption ($p<0.05$). Parents of children who believe in the adverse effect of processed meat consumed less ($p<0.05$).

Conclusions: Most of the parents decreased processed meat consumption because of its adverse health effect. Parents prepared lunch boxes and preferred homemade food for their children. While the educational level of parents decreased, the amount of processed meat consumption of children increased.

Keywords: Meat Products; Feeding Behavior; Health; Students; Parents.

RESUMEN

Introducción: La carne procesada tiene efectos indeseables en la calidad de la dieta especialmente en niños y adolescentes, ya que el alto consumo podría aumentar la prevalencia de obesidad, enfermedades cardiovasculares, diabetes y cáncer. El objetivo del estudio fue registrar el consumo de carne procesada en niños (entre 6 y 10 años de edad) y observar las actitudes de sus padres sobre el consumo y compra de carne procesada.

Material y métodos: Estudio transversal con la participación de 297 escolares de 1º a 4º año de una escuela primaria de Estambul y sus padres. Se registró el consumo de carne procesado por los niños, así como las opiniones y actitudes durante la compra de carne procesada de los padres. Se realizó análisis de Chi-cuadrado, correlación de Spearman, Kruskal Wallis (Tamhane) en el programa estadístico SPSS. Los resultados se evaluaron en el intervalo de confianza (IC) del 95% y en el nivel de significancia de $p < 0,05$.

Resultados: Durante las compras, lo primero que analizaban los padres era la fecha de caducidad, mientras que el precio era analizado al final. No se observó relación estadísticamente significativa entre el Índice de Masa Corporal (IMC) de los niños y el consumo de carne procesada ($p>0.05$). Sin embargo, la edad y el consumo de carne procesada mostraron relación positiva estadísticamente significativa ($p<0.05$). Los hijos de padres que renocían el efecto adverso del consumo de carne procesada presentaron mejor consumo de carne procesada ($p < 0.05$).

Conclusiones: La mayoría de los padres disminuyeron el consumo de carne procesada debido a loa efectos adversos sobre la salud, prefiriendo la preparación de comida en casera. Los padres con mayor nivel educativo disminuyeron el consumo de carne procesada de sus hijos.

Palabras clave: Productos de la Carne; Conducta Alimentaria Salud; Estudiantes; Padres.

KEY MESSAGES

- We determined the processed meat consumption of children and estimated the attitudes of their parents about processed meat.
- Children of parents who recognize the health concerns about processed meat consumed less amount.
- Parents control their children's meals during school time and generally, they avoided and limited the children's processed meat consumption.

INTRODUCTION

Processing of meat products can be made physically such as grinding, cutting, mincing or chemically with the use of additives and with processing methods such as curing, smoking, fermentation to save organoleptic characteristics[1]. One of the processing methods is curing with salt (NaCl, KCl) to enhance microbial safety, desirable flavor and cured meat color[2]. Nitrite and other salt combinations are added to prevent *Clostridium botulinum* formation. Also, it can suppress other pathogen formations such as *Bacillus cereus, Staphylococcus aureus, Clostridium perfringens*[3-4].

A study carried out in different countries to evaluate the children's consumption of processed meat showed that more than 90% of participants from the Czech Republic, Denmark, France, Spain, Sweden, Japan identified themselves as processed meat consumers. When consumption was evaluated as g/bw (bodyweight) per day, participants in Spain showed much more consumption (2.7g/bw/day). In China, although the percentage of processed meat consumer was less (2.8% of participants), the amount that indicated by kg/bw per day was pretty much (2.2g/bw/day). Also, Greece data demonstrated minimum consumption amount (0.5g/bw/day)[5].

In another research conducted in Brazilian adolescents and adults, the results showed that processed meat consumption increased in the last decade especially among adolescents from 32.9 to 42.3 g/day (in 5 years)[6]. According to the European Prospective Investigation into Cancer and Nutrition (EPIC) survey, the proportions of meat eaten in different forms varied widely; the highest consumption of processed meat in men was 83 g/day in Germany, which was 54% of total meat. The lowest consumption of processed meat in men was 33.5 g/day in Italy, which was 24% of total meat. Especially in some countries, meat consumption increased in the last 50 years, like China, Brazilia, and Italy[7]. In Turkey, the processed poultry consumption was determined as 5.63 kg in a year[8]. Total red meat production in Turkey was 1.1 million tons, equal to 14.70 kg per capita, and processed meats count for approximately 40% of meat sales and are growing[9]. In the Moroccan population, there is a clear shift from a Mediterranean diet towards a western diet including high consumption of red and processed meat during the last decades, like in Turkey[10-11].

According to global consumer trends, regulations in nutritional properties and labeling as low or reduced trans fat, saturated fatty acid, nitrate, salt content can satisfy the healthy food demand of consumers, especially for processed meat derivative products[12]. However, the International Agency for Research of Cancer (IARC) classified the processed meat in carcinogenic class (Group 1)[2] and the American Medical Association indicates a relationship between nitrite/nitrate ingestion and gastrointestinal, colorectal cancer progression due to the formation of N-nitroso compounds (NOC's)[13-14]. The consumption of processed meat has undesirable effects on overall diet quality

especially in children and adolescents because the high consumption of processed meats could increase the prevalence of obesity, cardiovascular disease, type 2 diabetes, and other metabolic abnormalities through the toxic effect of nitrosamine on beta cells[15-16].

During the process or preparation of meat products, some chemicals are occurred such as advanced glycation end products (AGEs) which can accumulate in tissues and stimulate pro-inflammatory cytokines that progress oxidative stress related to many chronic inflammatory diseases; heterocyclic aromatic amines (HAA) and polycyclic aromatic hydrocarbons (PAHs) that can cause disease especially cancer[17-18]. The temperature, cooking time and, distance between a heat source and food affect the levels of these chemicals[19]. Some adverse effects of the processed meat consumption are a threat to children's health. A study conducted in children had shown that early exposure to processed/ ultra-processed products can be a major effect on increased lipid profile in preschoolers and school groups[20]. A rise in processed product consumption was related to increased waist circumference in children at the ages of 4 to 8 and it can cause obesity which could be due to the hunger and satiety mechanism dysfunction in later stages[21] and, the sodium content of processed meat is related to dysregulation in blood pressure in childhood[22].

In Turkey, according to TÜBER 2015 (Nutrition Guideline for Turkey), processed meat is classified as optional food. The standard amount (20-30g) is specified in the guideline to enable control of the portion. Overall, in childhood, psychological and social development accelerates attitudes that generally gained and maintained lifelong[23]. Healthy nutrition should be adapted, and parents should be trained. For that reason, the aim of this study was to evaluate the processed meat consumption of children (between 6-10 ages) and to observe their parents' attitudes on processed meat consumption and purchasing.

MATERIAL AND METHODS

Population and Sample of Study

A cross-sectional study was conducted on children from the 1st, 2nd, 3rd, 4th classes at an elementary school in İstanbul, and their parents. There are 1300 students at the school, at least 297 children and parents were required with a 95% confidence level with a 5% margin of error. The necessary permission was obtained from the İstanbul Okan University Ethics Committee (Decree no.17, Date: 22.01.2020). The study was conducted within the knowledge of the school manager with written permission. All participants signed informed consent and were identified as volunteers for the study.

Data Collection

Data were obtained with a survey about the children's consumption of processed meat and their parents' attitudes on processed meat consumption and purchasing through interviews face-to-face by authors[24] during November-December 2019. The survey included questions about parents' demographical characteristics (gender, educational level, occupation) and children's data (gender, age, weight, height). Also, the children's Body Mass Index (BMI) was calculated from the height and weight reported by their parents. BMI identified with percentiles were classified as; <3% and between 3-15% underweight, 15-85% normal weight, 85-97% and> 97% overweight and obese respectively[23].

The parents' attitudes in processed meat shopping were registered: label information use (expiration date, brand, type of meat (red/white), food additives, nutritional value, price) and were given as categories according to priority use during the shopping (ordered from 1 to 6 respectively) in the market or butcher shop (n = 281). Also, they identified processed meat consumption changes according to last year (less/ neutral/more) and if they reduce consumption, it was asked for the main reason for it.

The children's processed meat consumption was examined as the processed meat consumption during school meals (lunch box preferences). The data was given by their parents. Frequency was ranked 1 to 6 respectively for each product such as every day, 3-4/1-2 in a week, 2-3/1 in a month, not consumed. Amount of consumption was classified as less than 1 serving, 1 serving (i.e. 20-30g) or more than 1 serving and which kind of processed meat (fermented sausage, ham, sausage- hot dog, pastrami, smoked meat, frozen meatball, ready to eat doner, nugget, and schnitzel) that they consume was questioned. At least the processed meat consumption and its' health concern relation according to parents were examined in the questionnaire.

Statistical Analysis

Statistical analysis of data was done with licensed Package for Social Sciences (SPSS) 21.0 program. Percentage (%), frequency, and the standard deviation of the results were calculated. For the analysis of label information use during purchasing processed meat, all categories (expiration date, brand, type of meat, food additives, nutritional value, price) were ordered from 1 to 6 according to priority and average answer (1-6) was determined for each category. Also, regarding lunch box preparation, meal types like sandwiches with cheese/ processed meat, meatball, schnitzel, sandwiches with cheese/tomato, homemade food, sandwiches with ham/ sausage were given and parents marked options according to their children preferences.

Kolmogorov Smirnov test was used to determine the distribution of continuous variables, and according to this test, the distribution was found as non-normal. Chi-square, Spearman correlation, and Kruskal Wallis were applied to evaluate the results. Chi-Square analysis was performed with the calculated mean value of consumption ($\bar{x}$= 5.50; once per month). Firstly, consumption frequency was determined for each child according to the evaluation of consumption from 1 (every day) to 6 (no consumption) then, arithmetic average consumption was calculated ($\bar{x}$= 5.50) and more frequent consumption was categorized as every day, 3-4 or 1-2 times in a week, 2-3 times per month; also, less frequent than mean categorized as less than once a month and no consumption. Analysis was evaluated between consumption amount, frequencies, parents' attitudes towards the consumption of processed meat and their relationship with the independent variables such as education status of parents (elementary school, high school, university), age (6-10 years), thoughts of parents about processed meat and health concerns (agree/disagree/neutral), BMI respectively. Regarding BMI of children and consumption of processed meat, while chi-square analysis was demonstrating the distribution of less, mean, and more consumption among BMI groups, Spearman correlation analysis showed a positive/negative relationship between consumption and BMI status (underweight/ normal/overweight-obese). Results were assessed in 95% confidence interval (CI) and $p<0.05$ significance level.

RESULTS

Of the 297 students whose parents participated in the study, 31% were 1st grade, 21.5% were 2nd grade, 25.6% were 3rd and 21.9% were 4th grade. According to gender, 75.1% of parents were women and 24.9% of them were men. According to educational levels (primary school, high school, university, postgraduate) percentages are 13.1%, 37.4%, 45.1%, and 4.4% respectively. 55.9% of children are a girl and 44.1% of children are a boy. According to class, most students are from the 1st class (31%).

In the questionnaire, regarding the evaluation of label information, comparing means ($\bar{x}$) of order according to categories (expiry date, brand, type of meat, food additives, nutritional value, and price), the results showed that expiry date was evaluated firstly, the price was checked last during purchasing meat products. The priority order for all categories was given in the table (Table 1). Also, food additives information was evaluated as an important parameter by educated parents while reading the label.

Table 1. The comparison of priority of label information according to parents*

	Expiry Date	Brand	Type of meat	Food Additives	Nutritional Value	Price
N	281	281	281	281	281	281
Mean	2.45	2.90	2.96	3.58	4.33	4.75
Median	2.00	3.00	3.00	4.00	5.00	6.00
Std. Deviation (SD)*	1.36	1.48	1.46	1.66	1.31	1.68

*Std. Deviation and mean values were calculated from the participants' answers on the ranking of food labeling information priority from 1 to 6. 1: refers to the highest priority. Some participants didn't answer this question.

When the comparison of processed meat consumption was examined, participants specified that the consumption of processed meat according to last year was less (49%), not changed (47%), more (4%) respectively. Also, 69.4% of participants who decreased processed meat consumption indicated the adverse health effect of processed meat. When changes in consumption were identified concerning the educational levels of participants, there weren't any significant differences in means of preferences.

When considering the type of food the child consumes during lunchtime at school, lunch box preparation was preferred mostly by parents (80.1%). According to a prepared school meal type, while homemade food was the most preferred (42%), the least preferred choice was the sandwiches with processed meat (ham, sausages) (11.3%). The group which didn't prepare lunch boxes (19.9%)

chose mostly other options (66.1%) including cafeteria meals, sandwiches, and pastry and the majority of parents identified that their children are registered to the cafeteria of school, and they eat school meals at lunch (59%) (Table 2).

Table 2. Preparing lunch box and meal types

Lunch box preparation and meal types		Frequency (n)	Percent (%)
Prepare lunch	Yes	238	80.1
	No	59	19.9
	Total	297	100.0
Preferences of children who haven't got a lunch box	Other *	39	66.1
	Sandwiches with cheese	11	18.6
	Sandwiches with processed meat	6	10.2
	Meatballs	2	3.4
	Schnitzel	1	1.7
Preferences of children who have a lunch box	Sandwiches with cheese/tomato	111	46.6
	Homemade food	100	42.0
	Sandwiches with ham/ sausage	27	11.3

(Other*: cafeteria (58.9%), pastry (38.5%), all of them (schnitzel, sandwiches with processed meat/cheese, meatballs) (2.6%).

The processed meat consumption frequencies of the children were estimated, and the results demonstrated that most of the parents chose the ''not consume'' option excluding fermented sausage (consumption frequency; 1-2 times per week). Also, the most preferred option was "less than 1 portion" excluding doner, frozen meatballs, schnitzel, nugget (i.e., for these products the consumption amount was 1 portion).

The analysis demonstrated that children consumed more frequently than the mean when the educational levels of their parents decrease. However, a statistically significant result was not determined (p=0.4). The results about the relationship between the age of children and total processed meat consumption demonstrated that demand for this type of product increases with age (p=0.03). When comparing consumption frequency according to mean, people who agree with a positive relationship between processed meat consumption and health concerns identified that their children eat processed meat at mean or less frequent than mean which means consumption of once per month or less (p=0.03). Most children in each one of the BMI groups (underweight/ normal/ overweight- obese) consumed processed meat less frequently than the group means (once per month) and it wasn't found a relationship between increasing BMI and high consumption

(p>0.05) (Table 3). Also, with Spearman correlation analysis, it was found that there was a negative relationship between BMI groups and frequency of consumption (r=-.107, p=0.06), and a positive relationship between BMI and amounts of consumption (r=.061, p=0.3), but the relationships were not statistically significant (p>0.05) (Table 4).

Table 3. Evaluation of processed meat consumption of children with different parameters

		Frequency of total processed meat consumption of children				
		More than mean	**Less than mean**	**Mean**	**Total (100%)**	**p**
Education levels of parents	**Elementary school**	19 (48.7)	16 (41)	4 (10.3)	39	p = 0.4
	High school	48 (43.2)	57 (51.4)	6 (5.4)	111	
	University	55 (37.4)	82 (55.8)	10 (6.8)	147	
	Total	122 (41.1)	155 (52.2)	20 (6.7)	297	
Ages of children	**6-7**	28 (30.4)	55 (59.8)	9 (9.8)	92	p = 0.03
	8	26 (40.6)	37 (57.8)	1 (1.6)	64	
	9	32 (42.1)	38 (50.0)	6 (7.9)	76	
	10	36 (55.4)	25 (38.5)	4 (6.2)	65	
	Total	122(41.1)	155(52.2)	20 (6.7)	297	
		More than mean	**Mean/ Less than mean**		**Total**	p= 0.03
Processed meat and health problems	**Agree**	77 (36.3)	135 (63.7)		212	
	Neutral	33 (51.6)	31 (48.4)		64	
	Disagree	12 (57.1)	9 (42.9)		21	
	Total	122 (41.1)	175 (58.9)		297	
BMI status		**More than mean**	**Less than mean**	**Mean**	Total	p=0.17
	Underweight	8 (25.8)	21 (67.7)	2 (6.5)	31	
	Normal	53 (39.0)	71 (52.2)	12 (8.8)	136	
	Overweight/Obese	61 (46.9)	63 (48.5)	6 (4.6)	130	
	Total	122 (41.1)	155 (52.2)	20 (6.7)	297	

P: chi-square, mean ($\bar{x}$)= 5.50 =once per month consumption which was obtained from participants answers was referenced according to the frequency of general processed meat consumption; 1: everyday, 2: 3-4 times per week, 3:1-2 times per week, 4: 2-3 times per month, 5: once per month, 6: none.

Table 4. Relationships between BMI Status of children with frequency/amount of processed meat consumption

Relationship between consumption and BMI of children	r	p
Frequency of consumption	-.107	> 0.05
Amount of consumption	.061	> 0.05

DISCUSSION

As a result of the study, most of the participants specified that a nutritional label is one of the important factors while buying a product. Also, the studies show that there is a positive association between a healthy diet and reading nutrition information[25]. In this study, expiration date and brand, such as non-nutritional attributes were placed as more important, and the price was the last information used during shopping. Kızılaslan N and Kızılaslan H[26] in their study demonstrated that nutritional value and the ingredients are the most important information for consumers. There is a correlation between brand and price according to participants and has the second highest priority among label information. Since this study was performed at a public school located at a place where people have an average economical income, it could explain why the price could not be considered as one of the important factors during purchasing. Educated people to use the nutritional label to get information about the food product mostly[27]. Food additives information ranked as the most important knowledge on the food labels according to well-educated parents. The reason could be because low-educated parents don't have enough awareness and knowledge to evaluate information. According to research, low-educated consumers need more information and education about food additives[28].

Another result demonstrated that most of the participants who decreased processed meat consumption according to last year, mentioned the adverse effect of processed meat on health, regardless of educational level. Yaylak et al[24] in their study found that when educational and socio-economic status increase, red meat purchasing also increases despite its adverse effect. Scientific studies showed that increasing processed meat intake by 100g/day is positively associated with low educational level[29] and another work showed that the high consumption of ultra-processed food among children older than 16 months is associated with low maternal education (less than 12 years)[30]. This study also showed that while educational levels increase, children consume less processed meat than the mean. The result was not statistically significant.

A study that analyzed socio-demographic factors in food choices of children at the age of 7-16 demonstrated that elder children prefer processed meat more than younger children[31] Increasing age and consumption were statistically related in this study.

Nutritional habits such as low processed/red meat and high amounts of dairy (fat reduced), vegetables, and grains consumption were effective in the prevention of central obesity[32]. Ultra-processed food including processed meat, pastries, beverages consumption in high amounts was related to increasing BMI[33]. In the study about ultra-processed meat intake, it wasn't found a relationship between overweight and obesity situation and higher ultra-processed meat

consumption[34]. In another research, it was mentioned that processed foods that contain high caloric value could be effective in short-term weight gain, but long-term obesity progression was related to metabolic dysfunction[35]. In this study, when compared BMI status of children, most children in each one of the BMI groups (underweight/ normal/ overweight- obese) consumed processed meat less frequently than the group means (once per month). However, in each BMI group evaluated, there was a negative relation between the BMI groups and frequency of consumption; positive relation between the BMI and amounts of consumption also determined but the relationships were not statistically significant.

This study showed that there is a strong relationship between the attitude of parents and the nutritional habits of children. It is proven by scientific studies that the consumption of the processed meat is highly correlated with the occurrence of cancer. If the parents become aware of this fact, they could not continue to consume processed meats, at least try to find new alternatives. Since it was also demonstrated through this study that the education of parents, especially about a healthy diet, is very important for raising healthy generations and for improving public health, it is mandatory to educated people and support training programs at schools to improve children's health.

Although there are studies about the assessment of consumption of main nutritional groups among children, data about specific products like processed food are limited comparatively in our country. The results are limited to statements of 297 parents from an elementary school (public school) in the 2019-2020 school year. Comprehensive research can reveal interesting results with the help of different parameters like comparison of different districts, participation of parents from college (private school), assessment of adolescents, high school, and university students. It wasn't collected sufficient data about the relationship between processed meat consumption and diseases. It is recommended to evaluate this relationship in further studies.

CONCLUSIONS

In this study, it was observed that most of the parents who decreased processed meat consumption according to last year mentioned the adverse health effect of processed meat. A clear majority of parents prepared lunch boxes for school meals. Generally, the parents control their children's meals during schooltime and avoided processed meat consumption either by preparing lunch boxes or encourage their children to take their meals through the cafeteria. When the processed meat consumption of students was evaluated, it was seen that average consumption was once in a month and less than 1 portion (less than 20-30g). Children of conscious participants who believed in a positive relationship between health concerns and processed meat consumed less amount.

As a result, it shouldn't be ignored the importance of raising awareness of parents about processed meat consumption. Also, healthy food applications in school should be maintained to get children to adopt healthy nutrition habits for growing healthy generations.

AUTHORS' CONTRIBUTIONS

ASK, BK: Idea, Concept & Design; Writing the article; and Literature Review. BK: Data collection & Analysis.

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CONFLICT OF INTEREST

The authors state that there are no conflicts of interest in preparing the manuscript.

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